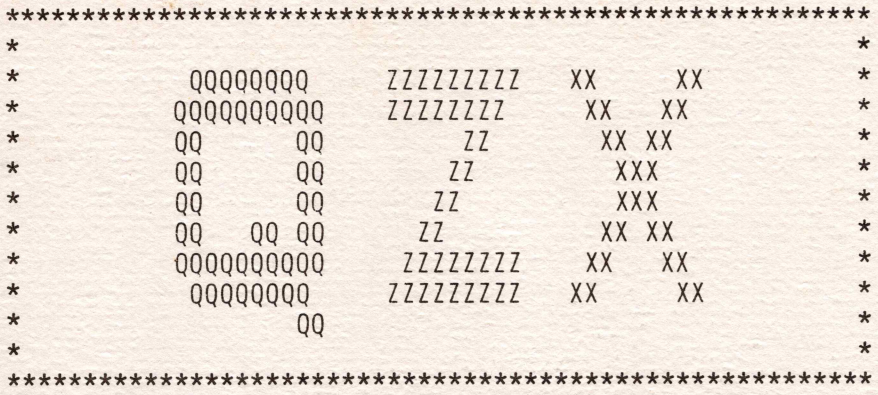
QQQQQQQQ ZZZZZZZZZ XX XX
QQQQQQQQQQ ZZZZZZZZ XX XX
QQ QQ ZZ XX XX
QQ QQ ZZ XXX
QQ QQ ZZ XXX
QQ QQ QQ ZZ XX XX
QQQQQQQQQQ ZZZZZZZZ XX XX
QQQQQQQQ ZZZZZZZZZ XX XX
QQ

The Journal Covering Amateur Radio & Sinclair Computers
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Coming Up!

Broadcast Bandscan Program, from CTM by J. Smith

Composite Color On The QL

Fred Nachbaur
(from Quantum Levels Magazine)

You might have bought a composite color monitor for a previous computer system, and then bought a QL with the assumption that you could use your monitor with it. I know how disappointed you felt when you found out that Sinclair made no provision to run NTSC (American standard) composite color monitors. Now you either have to live with monochrome, go back to the old family TV, or else shell out for an RGB monitor, right? Wrong! Believe it or not, the required video signal exists inside the QL, but isn't brought out to the connector. A few dollars and a simple hack job is all it takes to remedy the situation. The resulting image, while not as good as an RGB picture, is considerably better than the typical television set.

The idea is very simple, We merely take the NTSC video signal from the input to the TV modulator! Implementing this requires only a couple connectors and lengths of cable, and a Phase 1 disassembly of the QL (See the previous issue).

Many monitors (such as the one I'm using) contain a built-in audio amplifier and speaker, so you can divert the QL sound output to the monitor at the same time. This results in a better tonal quality, as well as full control of the volume of the sound. Did you ever notice how the sound can seem barely audible during the daytime hustle and bustle, yet embarrassingly loud late at night? If you pipe it to your monitor, you can adjust the volume, "to taste."

Before we get to the details, I should mention that not all color composite monitors will work properly if you select "monitor" mode (F1) on power-up. This is not so much the fault of the monitors, as it is the fact that the vertical retrace interval in this mode is 50Hz. (European) instead of the 60 Hz. for which the monitors were designed. Monochrome monitors seem to be more forgiving about the discrepancy, but even they can show pulsing effects in this mode. Color monitors seem to be more finicky; my particular monitor shows a pronounced and annoying "breathing" in this mode. In "TV" mode (F2) it looks great. So this would appear to solve the problem, except that some software (e.g. QL CHESS) runs in "Monitor" mode regardless of what you select on power-up. Perhaps someone will discover a cure for this as time goes on. Meanwhile, it won't hurt to try it out with your particular unit.

I used a 1/8" stereo in-line phone jack connected to a short pig-tail of two conductor "mic cable" to bring the audio and video signals out of the QL and a mating plug to send the signals to the monitor. (This is the kind of phone connector used on "Walkman"-type portable stereos, and is available at Radio Shack.) This makes the pigtail coming out the back of the QL relatively small and unobtrusive. This text and the accompanying diagram assumes this type of connector. However, you may prefer another type of connector (e.g. a 3 pin DIN.)

Here's how you go about doing it:

1: prepare a short length (about 6") of two conductor mike cable. That is, a cable with two wires surrounded by a shield.

2: Connect one end of this "pigtail" to a female 1/8" inline stereo phone jack. Note which wire goes to the tip (I made this the video terminal), and which goes to the inner conductor (audio). The shield goes to the "ground" terminal.

3: Do a Phase 1 disassembly of your QL.

4: Cut a channel, wide enough to pass your pigtail, in the rear apron of the QL. The best place to put this channel or cutout is right above the TV channel selector switch, to the left of the modulator. I used a soldering iron to melt down through the plastic; after letting it cool, the "flash" is easily trimmed away using an Xacto knife. Make the slot deep enough to prevent severely pinching the cable on re-assembly. (A mild "pinch" is beneficial, as it helps prevent the pigtail from being pulled loose.) With the cable I used, I had to cut down about 7 mm.

5: Solder the shield to the top of the modulator case. Connect your video wire to the center terminal of the modulator.

6: Disconnect the speaker by pulling up on the black plastic part of the socket until the wires easily pull loose. Tape up the exposed ends to prevent shorts, and tuck the wires somewhere out of the way.

7: Connect a 470-ohm resistor to the speaker socket. This resistor may not be necessary for your monitor or audio amp., but its installation is good practice. Connect your audio line to this resistor, at the terminal nearest the front of the computer.

8: Make up a cable to the monitor, with a male stereo phone jack at one end, and two RCA jacks (or whatever your monitor needs) at the other. See the diagram. Also refer to the notes below.

9: Test your set-up, then re-assemble the computer.

In most cases, it is NOT necessary or

even desirable to connect the audio "ground" to the shield. Doing so with my monitor causes a ground loop., resulting in a low-level (yet annoying) 60 Hz hum. The hook-up shown is the easiest way to connect two plugs to one cable; only if you get a hum with your particular monitor should you try running a jumper between the case of the video plug and the case of the audio plug.

If your setup seems to work but the video level is too low (can't get enough contrast), then there is a higher-level point from which you can take your signal. This is directly at the output of the MC1377 (pin 9). This point is also accessible at the right end of the 180-ohm resistor (R85, brown-grey-brown) just in front of the modulator. Don't do this unless you really have to, since this increases the possibility of damaging the MC1377 in the (admittedly rare) event of a monitor malfunction.

If the audio level is far too high for your monitor's amplifier, try putting a resistor in series with the audio line. Start with 10K, and increase it until you get an acceptable level.

Looking for a bargain on composite monitors? (This is especially for those who have other computers with composite video outputs; if the QL is your only color machine, you'd be advised to purchase the QL "Vsion" RGB monitor.) Check out the Commodore monitor, which is a very good unit for the price. Another one that's pretty good is the Sakata 13" SC-100, sold by JDR Microdevices for $169. (This is the one I have.)

Packet on the T/S 1500
K5XY

Here are some hints and kinks on running the T/S 1500 on packet embedded in the difficulties I had starting up one morning. These hints are good for the ZX81 and T/S 1000 too.

I came into the radio room and turned on the TV set to see what had collected on packet overnight. I had left the Pac Comm TNC running, so traffic on the channel would collect in the buffer. I had left the T/S 1500 running because it uses little energy and the less it is turned on and off the better. I had turned the TV off because I wanted to save the CRT. Really I should have just turned the brightness way down. That would keep patterns from being burned into the screen, but then the filament would still have been running.

Unfortunately, as I reached for the TV switch my hand hit the COMLINK I RS 232 adapter attached to the accessory slot in the rear of the T/S 1500 sitting on top of my TNC. When the TV had warmed up, I got nothing but a gray screen, not even a cursor. RAM wobble had struck again. I should have been using my little RAM pack adapter consisting of a plug for the accessory socket and a socket for the RAM connected by a short length of flexible flat ribbon cable. This adapter separates the RAM (or COMLINK I in this case) from the computer and cuts down on the intermittent connection which a little RAM movement causes and which freezes up the computer. But I wasn't using the adapter, so there was nothing I could do except turn the T/S 1500 off and on again.

Of course, that erased all my canned messages stored in the REM statements of the program which ran the COMLINK I: but, because the computer had frozen up, they were useless anyway. So I reentered my COMLINK I program and ran it to start up again. The COMLINK I answered as usual than I pushed the ENTER key to select the default communications parameters. Unfortunately the usual CMD: prompt from the TNC did not appear on my screen.

What else could have gone wrong. Pushing the ENTER button just caused the screen to scroll. I sent the command character three times just in case the TNC had gotten into the transparent mode somehow. I checked that the TNC pilot light was lit. I exited the COMLINK I program, rewrote its control program (only one line) and started over again. Still no TNC prompt. It was time to think instead of just pushing keys.

The TV was working. The T/S 1500 was working. The COMLINK I was working. Then it dawned on me. When I left last night I had sent the TNC an XOFF (shift7 S) so that it would store the traffic in its buffer instead of running it to the turned-off TV screen. I had cut the communication line between the COMLINK I and the TNC. I sent an XON (shift7 Q) to restore the connection, the buffer full of traffic scrolled across my TV screen and everything was normal again.

Moral of this story - don't blame the EQUIPMENT until the OPERATOR has been checked out.

Comlink Communication Program
K5XY

As readers of QZX know, it is very easy to get the ZX-81, T/S 1000, and T/S 1500 on packet by using a COMLINK I RS232 adapter

between the computer and your TNC. The COMLINK I adapter has a built in terminal and translation program that makes operation simplicity itself. It does require you to write a very simple basic program to get it started. I list mine below for those beginners who are not too familiar with computers as yet. After the program, I have comments to tell you why I put in a particular line.

```
010 RAND USER 8200
100 REM C K5XY V WD5HTR$
200 REM C KA5ZEC-1$
300 REM My equipment is a 5/8
305 REM wavelength antenna @ 40 feet
310 REM an Azden PCS 4000,
320 REM a MFJ 1270 TNC,
330 REM and a Sinclair T/S 1500 computer.$
400 REM C WA5JXY-1 v WD5HTR,WD5HTQ$
500 REM C N5DEH V WD5HTR WB5QHS W7GNP-1
                FLAG$
```

Line 10 is the only line really necessary in this program. It is the line which calls the terminal and translation program in the EPROM contained in the COMLINK I adapter. This line sends the Z80 in the Sinclair computer to memory location 8200. But there is no memory location 8200 in the T/S 1500. But there is in the COMLINK I, so control is transferred to the adapter and you are in business.

Line 100 is a REM statement which is used by the COMLINK I as one of nine possible canned messages. The adapter automatically sends out in a frame over the air the contents of this REM. I use this message to check out my system when I first turn it back on. The statement asks my TNC to C(onnect) to me through WD5HTR which is the main wide area digipeater in my area. The $ symbol at the end of the statement is really a British pound symbol on the shifted space bar. The shifted space bar is what you are to type here. This symbol at the end of a statement tells the TNC to send the statement as a frame immediately with out waiting for me to add a carriage return. (In this context, the adapter translates the $ symbol into a carriage return for the TNC).

Line 200 is the next message, which is a command to the TNC to connect me to the local Packet Bulletin Board Station (PBBS). The -1 after the call is a secondary station identifier (SSID) which allows the owner of a PBBS to use his own call when he is on the air in person.

Lines 300 to line 330 is one message which is sent in one packet and describes my station. It is not a command as the previous messages were but is just a series of words which are dropped into my conversation whenever I push the appropriate keys. They are all sent as a group because all the lines start with three hundred. I broke this message up into four REM statements for ease of editing. Each statement contains a description of a separate element of my packet station so I can easily change it as my packet station is revised.

Line 400 connects me to the big PBBS in El Paso, TX, 50 miles to the south. I do this by sending my packets to the wide area digipeater 60 miles to the north. That station sends them to a local area digipeater in El Paso which in turn repeats them to the PBBS (WA5JXY-1). All this repeating takes less than a second on a clear channel.

Line 500 connects me to a PBBS in Arizona about 500 miles away. Note that in this command I separate the different digipeaters by a space instead of a comma as I did in the previous command. Either separator can be used. On the T/S 1500, I have to press two keys to get a "," but only one key to get a space. Also note that the last digipeater is known by its alias, FLAG, instead of by a ham call. This usage is all right on packet. That station will automatically identify with its FCC call letters at legal intervals. The alias is used as a memory aid because that station is located in Flagstaff, AZ.

I could have added four more messages (as long as they did not fill up my memory space). These canned massages are automatically activated by the COMLINK I adapter when you press shift 8 #, where # represents the hundreds digit of the line number of the message you want sent. The adapter will tell you that the asked for message is undefined or not available if you put a wrong number here.

The important thing to remember is that only the first line is needed.

Microwave Path Loss Calculations
Leslie Varnicle, WA3QLW

Elsewhere in this issue is a design program used to calculate the path loss, antenna size, and fade margin in commercial microwave systems. It will work on a TS1000 or 2068 with the necessary modifications.

TI Keyboard for the T/S 1000
Another way of adding one

Patrick J. Patterson
(Reprinted with permission, from
CTM Magazine, August 1986

I recently did a TS1000 keyboard conversion using a TI 'dump' keyboard and an article by Robert Hartung in the April '85 issue of CTM. After completion of the modifications I found that all I had were two keyboards that didn't do anything. Mr. Hartung described in a later update that some of the dumped keyboards had diodes inside or other obstacles so I had to find a matrix diagram, break all the foil traces on the pc board to isolate the keys, and then hardware the whole thing. I have always found it personally annoying that in any keyboard conversion article I have read that it is assumed the reader knows what the connection matrix of the keyboard to be replaced is. So I am presenting that information here for those of you as ignorant as I am and also a little afraid of ripping off that TS1000 original keyboard so I could stare at it and try to figure out just how the darn thing is connected! With this diagram you should be able to modify most keyboards that are readily available. (Ed. note: Several excellent keyboard add-on articles have appeared in past QZX issues.)

Begin by breaking all the foil traces around each key and identifying two solder points that show a continuity closure between them when the key is depressed (see fig. 3) A simple way to break the traces is to take a drill fitted with a disc sander and gently "wipe" over the traces between keys till the foil is broken.

Step two is to hardwire between the keys as in figure 1. Select one set of solder points positioned the same on all keys and solder a wire connecting them vertically then "looping" it over to the next row as shown in the diagrams. The wire used can be a plastic coated type where you can melt off a small section of insulation and then solder that bared section to the point on the keytrace, looping the wire to the next keytrace and continuing so until the proper keys on each wire run are interconnected (see figs 1 & 3). The wire then comes off the last key in a row and will eventually connect to the back of the pc board in the computer on the designated trace marked by letters on the board. Fig. 2 shows you what the back of the computer pc board looks like and where the traces you need to connect to are located and how they are marked.

I strongly recommend that you use ribbon cable and a set of connectors to install the keyboard because when I connected mine with hardwiring I found the slow, fast and llist commands didn't work with the second keyboard connected, and rather than spend hours trying to figure out why, I just cut the wires and added plugs so that if I needed to use those commands I could unplug the second keyboard and the original would work normally. I could enter the needed keyword and then plug the other keyboard back in and continue. The installation is also a lot neater with ribbon cable.

When you solder to the computer board, let the iron heat and then pull the plug on it while you make a connection to avoid having stray electrical currents from destroying the ICs. You can check Mr. Hartung's article for other details. I'll leave such details as the mounting of the new keyboard, wire lengths. and such to you as it may vary depending on the keyboard you are using. Any extra keys left on the new keyboard, such as a shift lock or numeric keypad can just be connected in parallel with it's mate key on the keyboard as is the space bar in Fig. 1.

As for marking the keys, you are also on your own but I will make some suggestions. I have seen kits with self adhesive markings available but I can't find the ad again. Some places also have self adhesive raised letter key sheets designed to be placed over the old TS keyboard. I had one of those and cut up the letters (they fit quite well) and stuck those on the keys of the new board. One could also possibly fill the depressions with auto body putty, sand it smooth and paint on the symbols. The rest of the details are up to you. (Note: there isn't a figure 2.) Good luck! Patrick J. Patterson, 1707 Burdick Street, Oshkosh, WI 54901

A Precision Frequency-Generator Program
A unique program which will be of great value to you! (T/S 1000/1500)

By David A. Nordquest
Reprinted with permission from
CTM Magazine, August 1986

For the electronics experimenter, a precise audio frequency generator has a variety of uses. It can be used to test active filters, to check the frequency response of amplifiers and speakers, to tune electronic and other musical instruments, and even to check one's hearing. Unfortunately, commercial audio generators are expensive and home-built models often lack accuracy. However, simple programs can turn home computers into

highly precise tone generators.

Although the Timex/Sinclair 1000 & 1500 lack a music chip, sounds can be produced through the MIC port. Because the Z-80 chip used in these computers runs at 3.23 MHz, tones accurate to a fraction of a microsecond are possible. Although filtered, the output will show signs of TV sync pulses when viewed on a scope. In most applications, this will present no problem, but extra filtering or use of a Schmidt trigger might be advisable when a pure waveform is needed.

The program printed below asks for a frequency to be entered, calculates the number of clock cycles needed to produce it, and then creates B- and C- loops that are either exactly on target or not less than 7 or more than 24 cycles away from the target. Machine code commands are then poked in which, in this program, do absolutely nothing. By doing nothing for precisely the correct amount of time, they allow the period of the tone to be set to within a clock cycle. These commands are chosen from A$, which consists of sets of commands, each of which takes one clock cycle longer than the last. Using this technique is necessary for accuracy greater than the four-clock-cycle period of the shortest Z-80 command.

Entering C$, which is used by the program to poke in part of the machine code needed to generate tones, is tricky. It contains three commands which must be entered with the cursor in the keyword mode. Ordinarily, it leaves this mode after the first command is entered. The simplest procedure is to enter the last command first, then to move the cursor to the left of it and enter the next-to-the-last, and so on. The other elements of the string can then be entered by moving the cursor appropriately. Be absolutely sure to enter one space and one space only between the colon and the dollar sign. This space may not be noticeable in the printed version of the program, but MUST be included. There are no other spaces in C$.

Table A must be poked into memory locations 16514 and 16534 before the program can be executed. Lines 5 and 11 through 17 should be deleted and the program should be started with a GOTO 10 command. RUN should not be used.

I hope you enjoy this article and get frequent use of this project. I would appreciate any suggestions, comments and modifications you may feel warranted. Also, if you modify the program to work on another computer, please let me or Chet know so we may tell others.

Please write or call me at:

David A. Nordquest
403 Wasson Court #15
River Falls, WI 54022
(715) 425-0060

TABLE A

```
33  0  0  17  1  0  219  254  6  0  14  0
13  32  -3  16  -7  6  0  248  127
```

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Precision Frequency Generator
PROGRAM LISTING

(spaces added for clarity)

```
 5 REM  "PRECISION FREQUENCY GENERATOR By D. NORDQUEST"
10 REM  (Any 50 characters, No quotes or brackets needed.)
11 FOR X= 16514 TO 16534
12 INPUT Y
13 POKE X, Y
14 NEXT X
15 STOP
16 REM "DELETE LINE 5 AND EXECUTE PROGRAM TO HERE, POKING IN TABLE A."
17 REM "AFTER ENTERING TABLE A, DELETE LINES 11 TO 17."
20 LET A$+ "0560000090091271270090091272480090 09
            2482480090091270560000090240000090 09    (REM: "No spaces.")
            2481271270092482481270092482482480 09
            0240001270090240002480091271272482 48
            1272482482480240001271270240001272 48
            0240002482480240001270780240000240 00"
30 LET C$= "PEEK COPY : $ 4 CLEAR (RAND ;"        (see text for C$ details)
40 PRINT "INPUT FREQUENCY IN HERTZ"
50 INPUT F
60 LET P= 1/F
70 PRINT "INPUT LENGTH IN SECONDS"
80 INPUT L
90 CLS
100 FAST
110 IF L>P*65535 THEN PRINT "OUT OF RANGE FOR FREQUENCY"
120 LET E= 65535- L/P
130 LET T= P*3231200
140 LET K= INT ((T- 120)/2)+ .5)
150 FOR B= 0 TO 255
160 IF K> (B*4111 + 4104) THEN GOTO 230
170 IF B= 0 THEN LET C= INT (K/16)
180 IF B> 0 THEN LET C= INT ((K- B* 31)/(B* 16+ 16))
190 LET D= (C* 16 AND B= 0) + (B* (31+ C* 16)+ 16* C AND B>0)
200 IF C= 255 THEN GOTO 230
210 LET M= K- D
220 IF M< 25 AND M> 6 OR F> 16000 OR M= 0 THEN GOTO 240
230 NEXT B
240 POKE 16515,E- (256* INT (E/256))
250 POKE 16516,INT (E/256)
260 POKE 16523,B+ 1
270 POKE 16525,C+ 1
280 POKE 16532,B+ 1
290 LET J= 0
300 LET B$= A$ (((M- 7)*12)+ 1) TO (((M- 7)*12)+ 12)
310 FOR V= 1 TO 2
320 FOR R= 1 TO 4
330 LET S= VAL B$ (R* 3- 2 TO R* 3)
340 IF S<> 9 THEN LET J= J+ 1
350 IF S<> 9 THEN POKE 16534+ J,S
360 NEXT R
370 LET J= J+ 10
380 NEXT V
390 LET I= (J- 20)/2
400 FOR W= 1 TO 10
410 LET Y= CODE C$ (W)
420 POKE 16534+ W+ I, Y
430 NEXT W
```

```
440 POKE 16535+ I+ 3, C+ 1
450 POKE 16545+ 2* I,48
460 POKE 16546+ 2*I, -27 -2*I
470 POKE 16547+ 2* I, 201
480 IF ((T- 120)/2- K)> .25 THEN POKE 16534, 248
490 IF PEEK 16534= 248 THEN LET M= M+ .5
500 IF K- ((T- 120)/2 )> .25 THEN POKE 16533, 127
510 IF PEEK 16533= 127 THEN LET M= M- .5
520 RAND USR 16514
530 PRINT "ACTUAL FREQUENCY WAS ", 1615600/ (D+ M+ 60)
540 PRINT
550 PRINT "ENTER R TO REPEAT TONE OR N FOR NEW TONE"
560 PRINT
570 INPUT Z$
580 IF Z$= "N" THEN GOTO 40
590 IF Z$= "R" THEN GOTO 520
600 STOP
```


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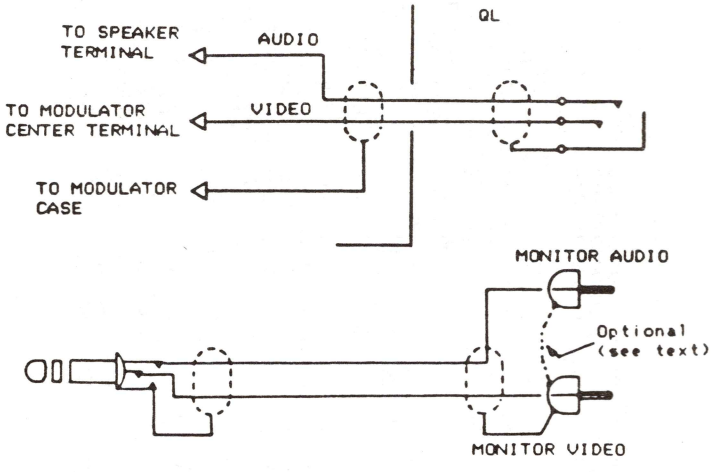
```
   5 PRINT "  PATH LOSS,   ANT
SIZE, AND    FADE MARGIN"
   6 LPRINT "PATH LOSS, ANT SIZE
, AND FADE MARGIN"
  10 PRINT "ENTER THE FOLLOWING:
"
  11 LPRINT "ENTER THE FOLLOWING
:"
  12 LPRINT
  15 PRINT
  20 PRINT "FREQ IN GHZ = "
  30 INPUT A
  40 LPRINT "FREQ IN GHZ = ";A
  50 PRINT "TX PWR IN DBM = "
  55 INPUT B
  60 LPRINT "TX PWR IN DBM = ";B
  70 PRINT "DISTANCE IN MI = "
  75 INPUT C
  80 LPRINT "DISTANCE IN MI = ";
C
  90 PRINT "FADE MARGIN IN DB =
"
 100 INPUT D
 110 LPRINT "FADE MARGIN IN DB =
";D
 120 PRINT "RX THRESH IN DBM (NE
G) = "
 130 INPUT E
 140 LPRINT "RX THRESH IN DBM (N
EG) = ";E
 150 PRINT "LINE LOSS IN DB/100
FT = "
 160 DIM F(11)
 170 INPUT F(1)
 180 LPRINT "LINE LOSS IN DB/100
FT = ";F(1)
 190 PRINT "LINE LENGTH AT LOC 1
 FT = "
 200 INPUT F(2)
 210 LPRINT "LINE LENGTH AT LOC
1,  FT = ";F(2)
 220 PRINT "LINE LENGTH AT LOC 2
 FT = "
 230 INPUT F(3)
 240 LPRINT "LINE LENGTH AT LOC
2,  FT = ";F(3)
 250 PRINT "ARE RADOMES USED? YE
S OR NO   "
 260 INPUT F$
 270 LPRINT "ARE RADOMES USED? Y
ES OR NO   ";F$
 290 PRINT "TX RF COMPONENT LOSS
 DB = "
 300 INPUT F(4)
 310 LPRINT "TX RF COMPONENT LOS
S, DB = ";F(4)
 320 PRINT "RX RF COMPUNENT LOSS
 DB = "
 330 INPUT F(5)
 340 LPRINT "RX RF COMPONENT LOS
S, DB = ";F(5)
 380 PRINT
 390 LET G=(INT ((96.6+20*LN A/L
N 10+20*LN C/LN 10)*100+.5))/100
 400 PRINT "PATH LOSS =";G;" DB"
 405 LPRINT "PATH LOSS =";G;" DB
"
 410 LET F(6)=F(1)*F(2)/100
 420 LET F(7)=F(1)*F(3)/100
 430 PRINT "LOC 1 LINE LOSS = ";
F(6);" DB"
 435 LPRINT "LOC 1 LINE LOSS = "
;F(6);" DB"
 440 PRINT "LOC 2 LINE LOSS = ";
F(7);" DB"
 445 LPRINT "LOC 2 LINE LOSS = "
;F(7);" DB"
 450 PRINT AT 21,0;"DEPRESS CONT
INUE TO CONTINUE"
 460 STOP
 470 LET H=D-B+F(6)+F(7)+F(4)+F(
5)+G+E
 480 PRINT "TOTAL REQUIRED ANT G
AIN = ";(INT (H*100+.5))/100
 485 LPRINT "TOTAL REQUIRED ANT
GAIN = ";(INT (H*100+.5))/100
 490 PRINT
 495 LPRINT
```

Microwave Path Loss Program

```
 500 PRINT "SELECT LOC 1 AND LOC
 2 ANT SIZE FROM THE FOLLOWING T
ABLE"
 505 LPRINT "SELECT LOC 1 AND LO
C 2 ANT SIZE FROM THE FOLLOWING
TABLE"
 506 LPRINT
 510 PRINT
 520 PRINT TAB 4;"ANT DIA";TAB 1
4;"GAIN";TAB 22;"GAIN X2"
 525 LPRINT TAB 4;"ANT DIA";TAB
14;"GAIN";TAB 22;"GAIN X2"
 526 LPRINT
 530 PRINT
 540 FOR N=2 TO 12 STEP 2
 550 LET J=20*LN N/LN 10+20*LN A
/LN 10+7.5
 560 LET J=(INT (J*100+.5))/100
 570 PRINT TAB 6;N;TAB 13;J;TAB
23;2*J
 575 LPRINT TAB 6;N;TAB 13;J;TAB
23;2*J
 580 NEXT N
 590 PRINT
 600 PRINT "LOC 1 ANT DIA = "
 610 INPUT F(8)
 620 LPRINT "LOC 1 ANT DIA = ";F
(8)
 625 LET J=(INT ((20*LN F(8)/LN
10+20*LN A/LN 10+7.5)*100+.5))/1
00
 630 PRINT "LOC 2 ANT DIA = "
 640 INPUT F(9)
 650 LPRINT "LOC 2 ANT DIA = ";F
(9)
 655 LET K=(INT ((20*LN F(9)/LN
10+20*LN A/LN 10+7.5)*100+.5))/1
00
 660 DIM R(12)
 670 LET R(2)=A**1.5/38
 680 LET R(4)=A**1.5/30
 690 LET R(6)=A**1.5/27
 700 LET R(8)=A**1.5/25
 710 LET R(10)=.174*A-.14
 720 LET R(12)=.18*A-.1
 730 IF F$="YES" THEN LET F(10)=
R(F(8))
 735 IF F$<>"YES" THEN LET F(10)
=0
 740 PRINT "LOC 1 RADOME LOSS =
";(INT (F(10)*100+.5))/100
 745 LPRINT "LOC 1 RADOME LOSS =
";(INT (F(10)*100+.5))/100
 750 IF F$="YES" THEN LET F(11)=
R(F(9))
 755 IF F$<>"YES" THEN LET F(11)
=0
 760 PRINT "LOC 2 RADOME LOSS =
";(INT (F(11)*100+.5))/100
 765 LPRINT "LOC 2 RADOME LOSS =
";(INT (F(11)*100+.5))/100
 770 PRINT "THE TOTAL ANT GAIN =
";(INT ((20*LN F(8)/LN 10+20*LN
 F(9)/LN 10+40*LN A/LN 10+15-F(1
0)-F(11))*100+.5))/100
 772 LPRINT "THE TOTAL ANT GAIN
= ";(INT ((20*LN F(8)/LN 10+20*L
N F(9)/LN 10+40*LN A/LN 10+15-F(
10)-F(11))*100+.5))/100
 775 PRINT
 780 PRINT "DO YOU WANT TO CHANG
E ANT SIZE  SEL? (YES OR NO)"
 790 INPUT B$
 800 IF B$="YES" THEN CLS
 810 IF B$="YES" THEN GOTO 470
 820 CLS
 830 LET L=(INT ((B-F(6)-F(4)+20
*LN F(8)/LN 10+20*LN A/LN 10+7.5
-F(10))*100+.5))/100
 835 PRINT "ERP LOC 1 = ";L;" DB
M"
 837 LPRINT "ERP LOC 1 = ";L;" D
BM"
 840 LET M=(INT ((B-F(7)-F(4)+20
*LN F(9)/LN 10+20*LN A/LN 10+7.5
-F(11))*100+.5))/100
 845 PRINT "ERP LOC 2 =   M;" DB
M"
```

```
 846 PRINT
 848 LPRINT "ERP LOC 2 = ";M;" D
BM"
 850 PRINT "LOC1 RX ANT INPUT LV
L,DBM=";(INT ((M-G)*100+.5))/100
 855 LPRINT "LOC1 RX ANT INPUT L
VL,DBM=";(INT ((M-G)*100+.5))/10
0
 860 PRINT "LOC1 RX RCK INPUT PW
R,DBM=";(INT ((M-G+J-F(6)-F(10))
*100+.5))/100
 865 LPRINT "LOC1 RX RCK INPUT P
WR,DBM=";(INT ((M-G+J-F(6)-F(10)
)*100+.5))/100
 870 PRINT "LOC1 RX INPUT PWR,DB
M=";(INT ((M-G+J-F(6)-F(10)-F(5)
)*100+.5))/100
 875 LPRINT "LOC1 RX INPUT PWR,D
BM=";(INT ((M-G+J-F(6)-F(10)-F(5
))*100+.5))/100
 880 PRINT
 885 LPRINT
 890 PRINT "LOC2 RX ANT INPUT LV
L,DBM=";(INT ((L-G)*100+.5))/100
 895 LPRINT "LOC2 RX ANT INPUT L
VL,DBM=";(INT ((L-G)*100+.5))/10
0
 900 PRINT "LOC2 RX RCK INPUT PW
R,DBM=";(INT ((L-G+K-F(7)-F(11))
*100+.5))/100
 905 LPRINT "LOC2 RX RCK INPUT P
WR,DBM=";(INT ((L-G+K-F(7)-F(11)
)*100+.5))/100
 910 PRINT "LOC2 RX INPUT PWR,DB
M=";(INT ((L-G+K-F(7)-F(11)-F(5)
)*100+.5))/100
 915 LPRINT "LOC2 RX INPUT PWR,D
BM=";(INT ((L-G+K-F(7)-F(11)-F(5
))*100+.5))/100
 920 PRINT
 925 LPRINT
 930 PRINT "FADE MARGIN=";(INT (
(L-G+K-F(7)-F(5)-F(11)-E)*100+.5
))/100;" DB"
 940 LPRINT "FADE MARGIN=";(INT
((L-G+K-F(7)-F(5)-F(11)-E)*100+.
5))/100;" DB"
9997 STOP
9998 SAVE "PTH LOS"
9999 GOTO 0
```



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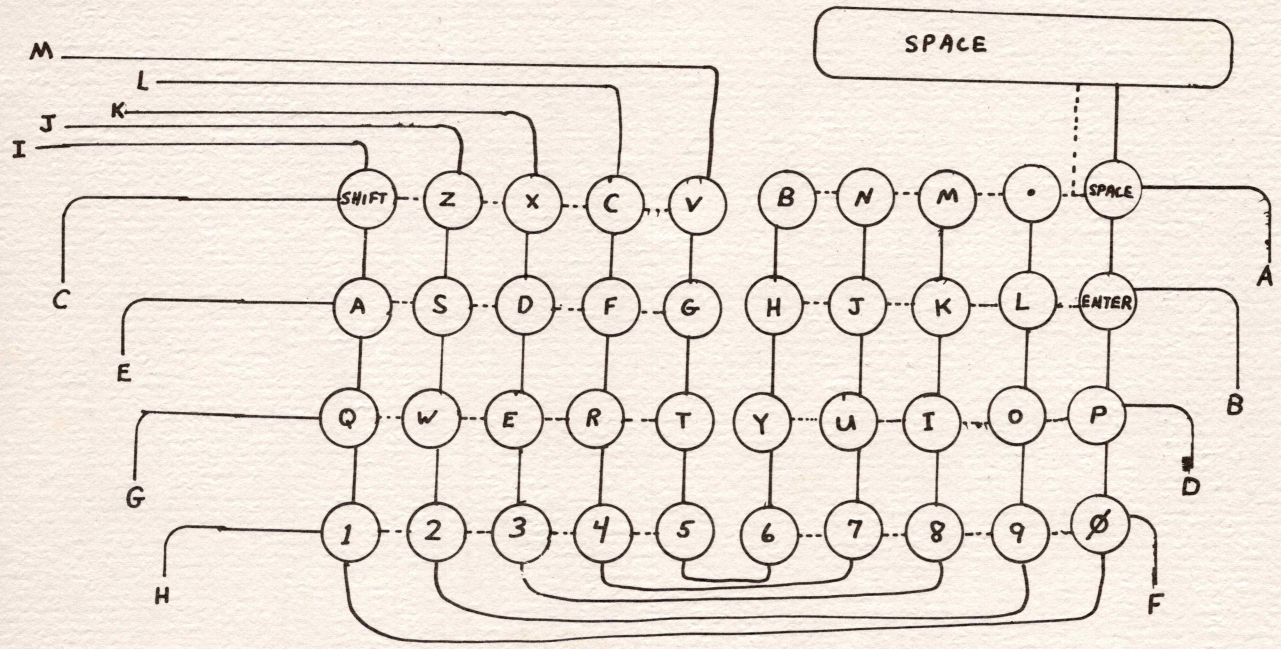

Figure 1.

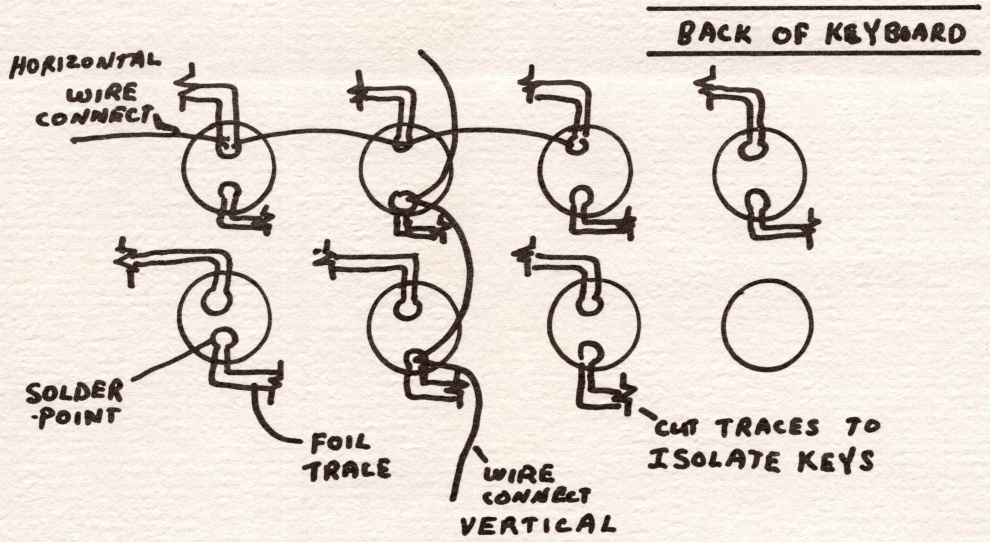

Figure 3

Keyboard Add-on Schematics

73, W4GHV & K5XY

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